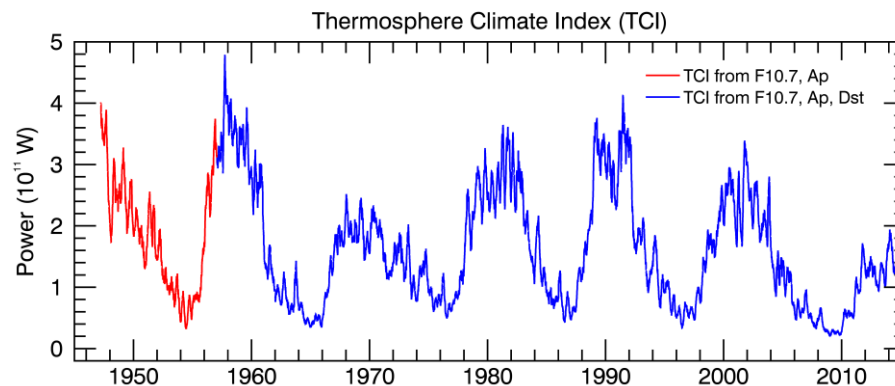


Infrared Radiation in the Thermosphere during Solar Cycle 24

Marty Mlynczak, NASA Langley Research Center, Hampton, VA
Linda Hunt, Science Systems and Applications, Inc., Hampton, VA
&
The SABER Science Team

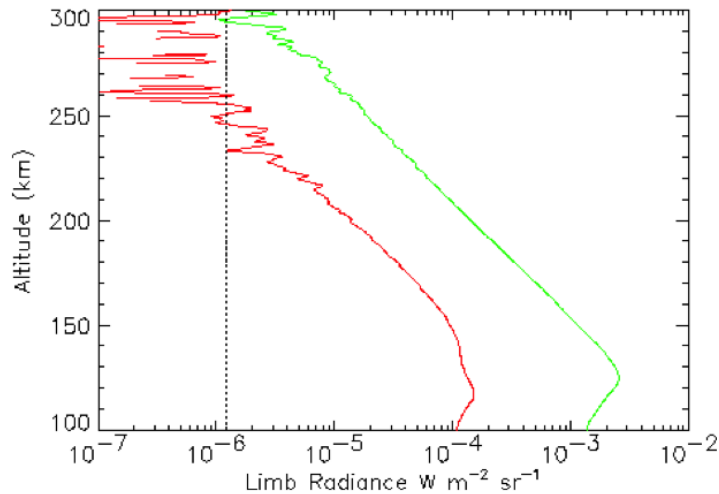


Outline

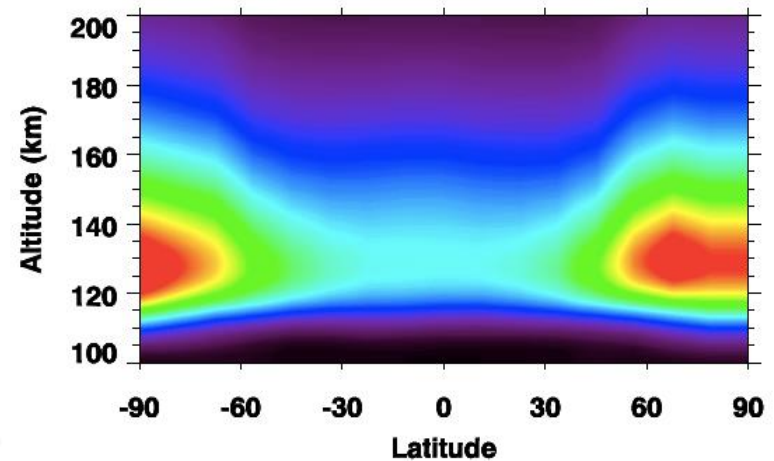
- SABER measurements of infrared radiance in the thermosphere
- Observed variability over the solar cycle, including occurrence of maximum cooling in SC24
- Development of a new index for thermosphere cooling

Thermosphere Power Derivation from SABER

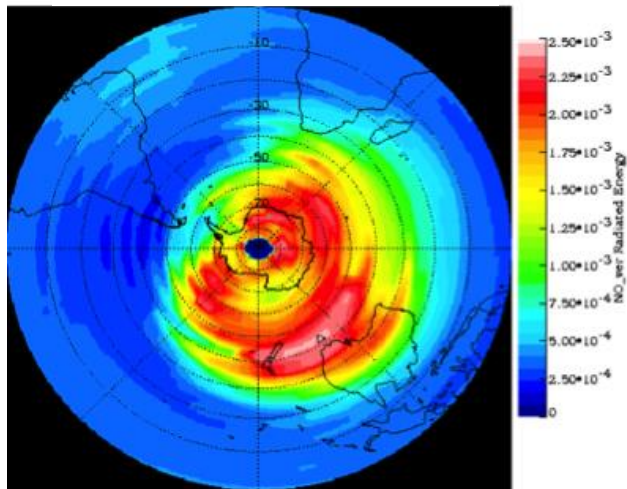
Radiance



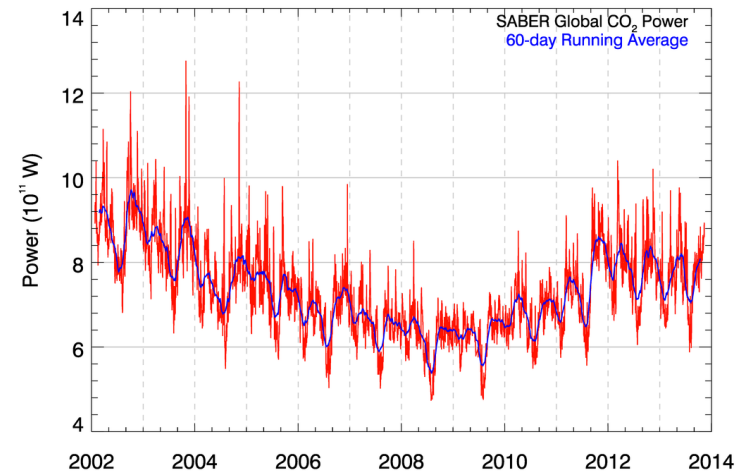
Cooling Rate W m⁻³



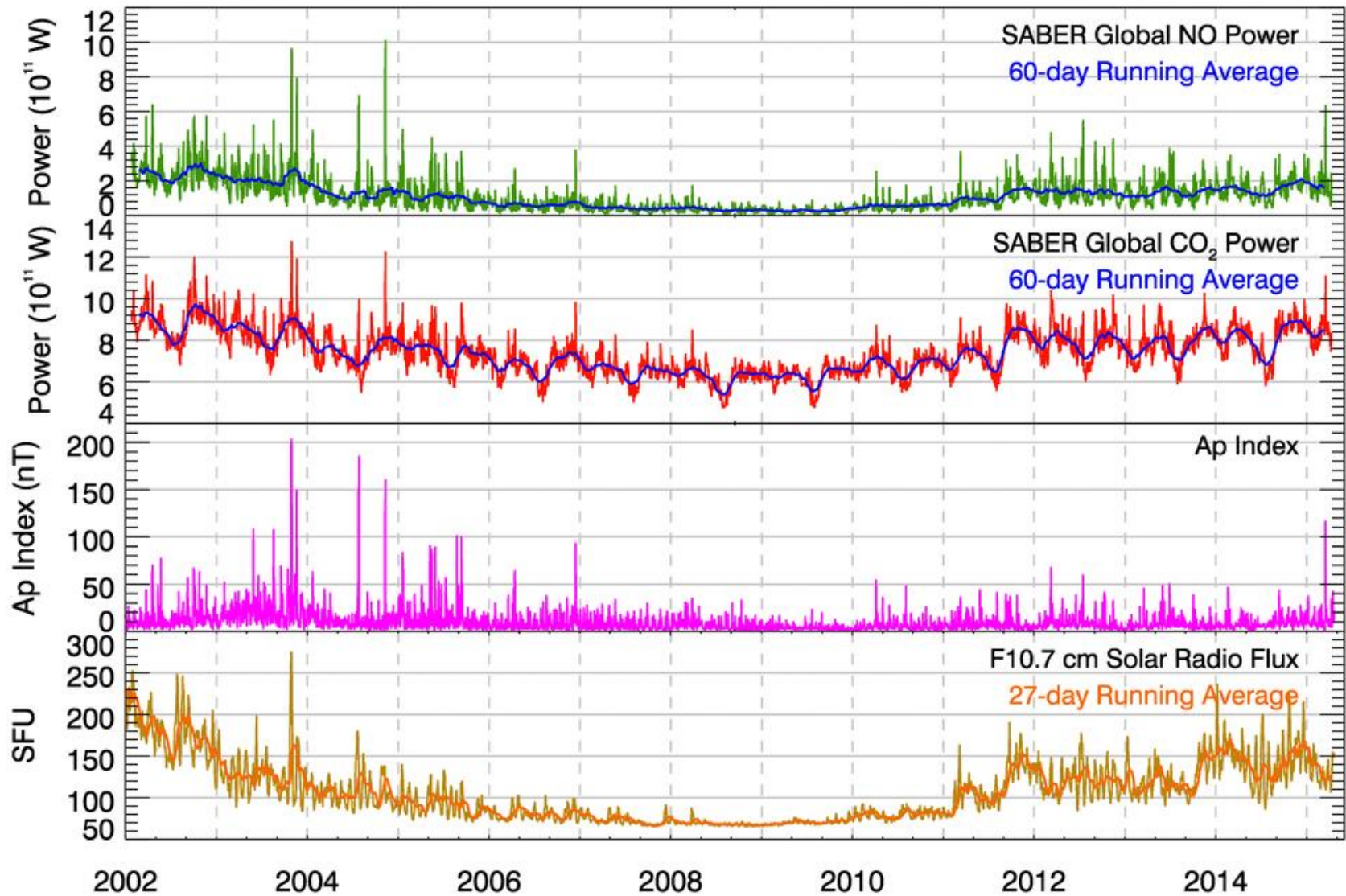
Radiated Flux W m⁻²



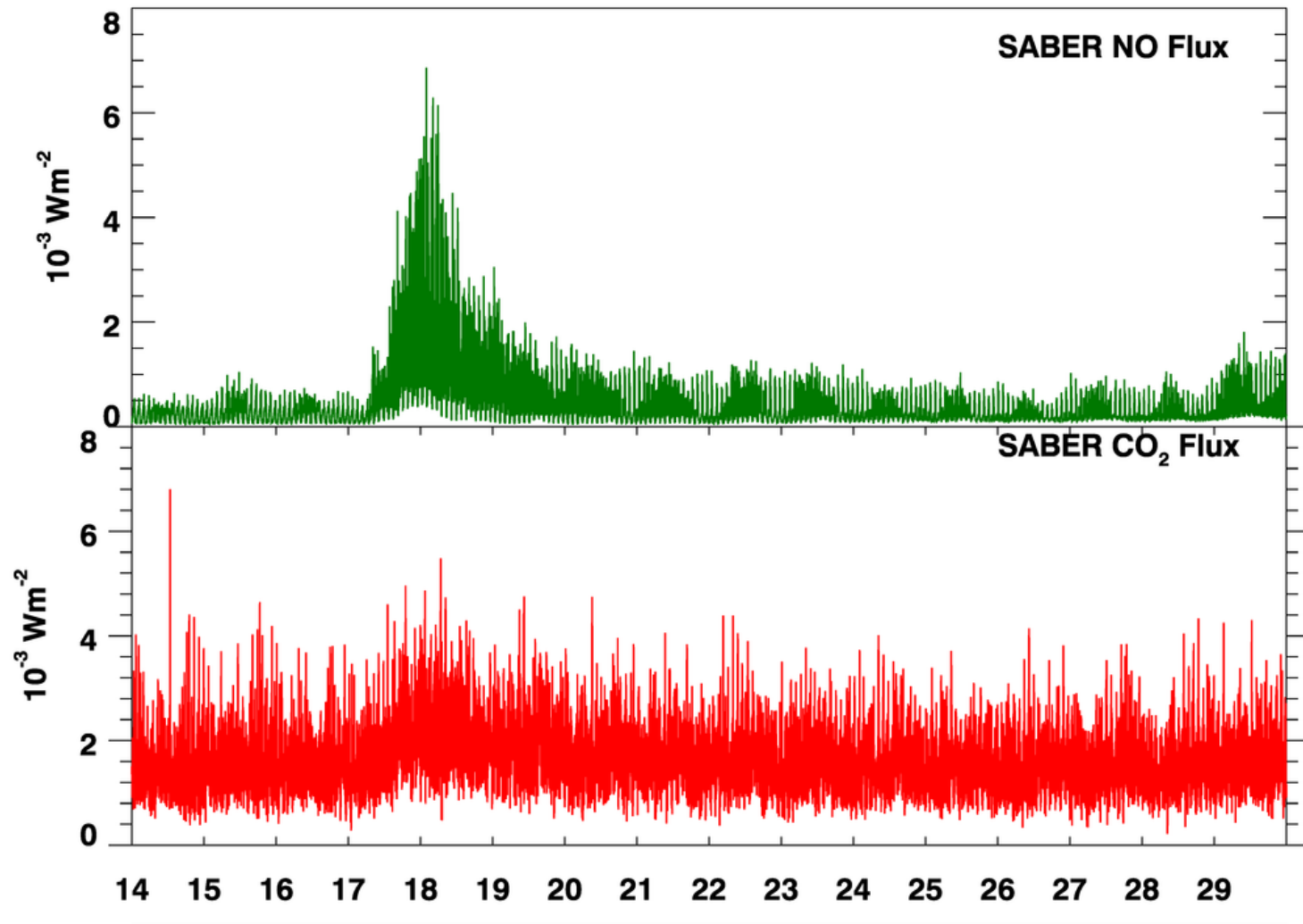
Daily Radiated Power (W)



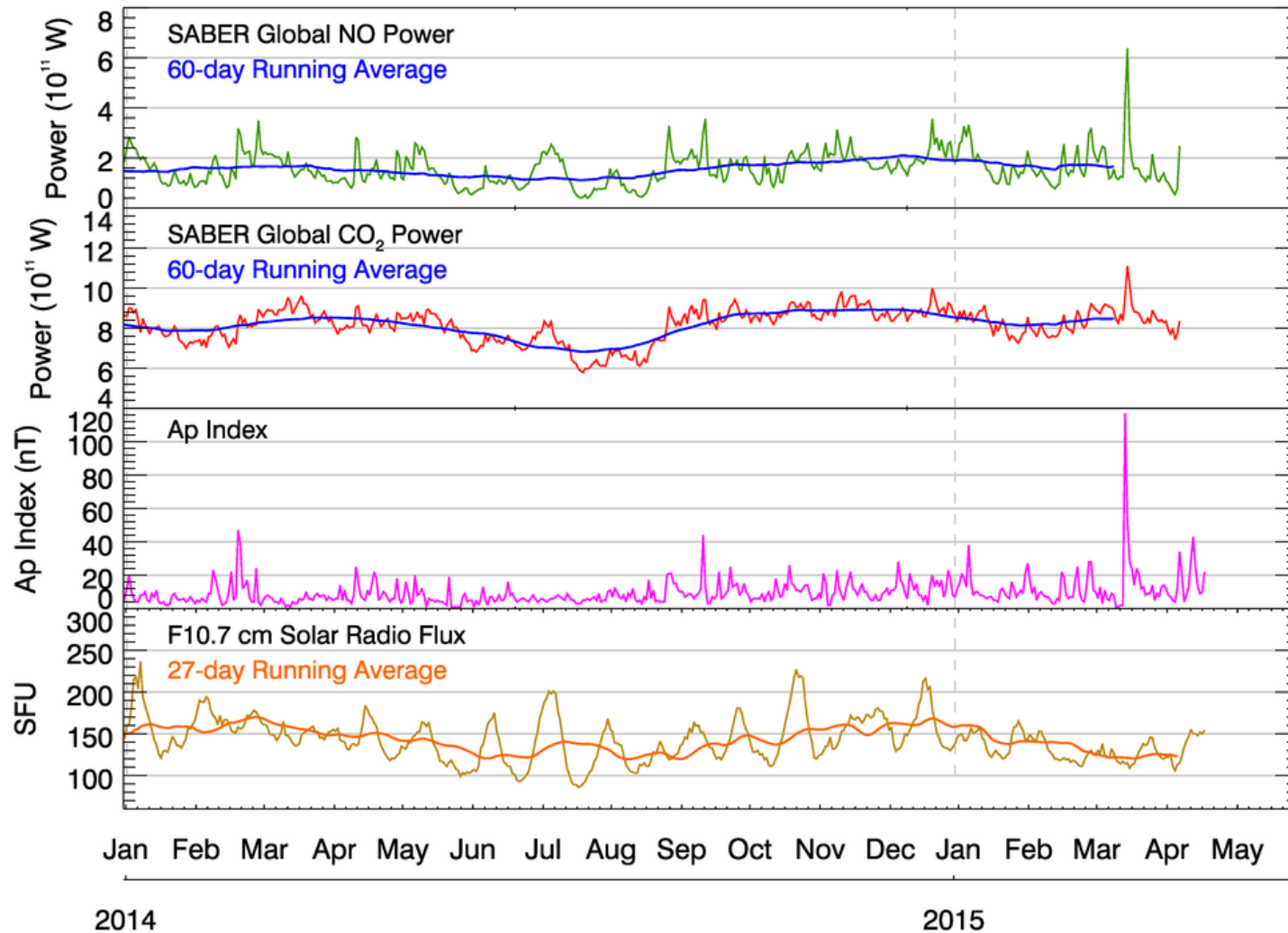
Observed Variability



St. Patrick's Day Storm

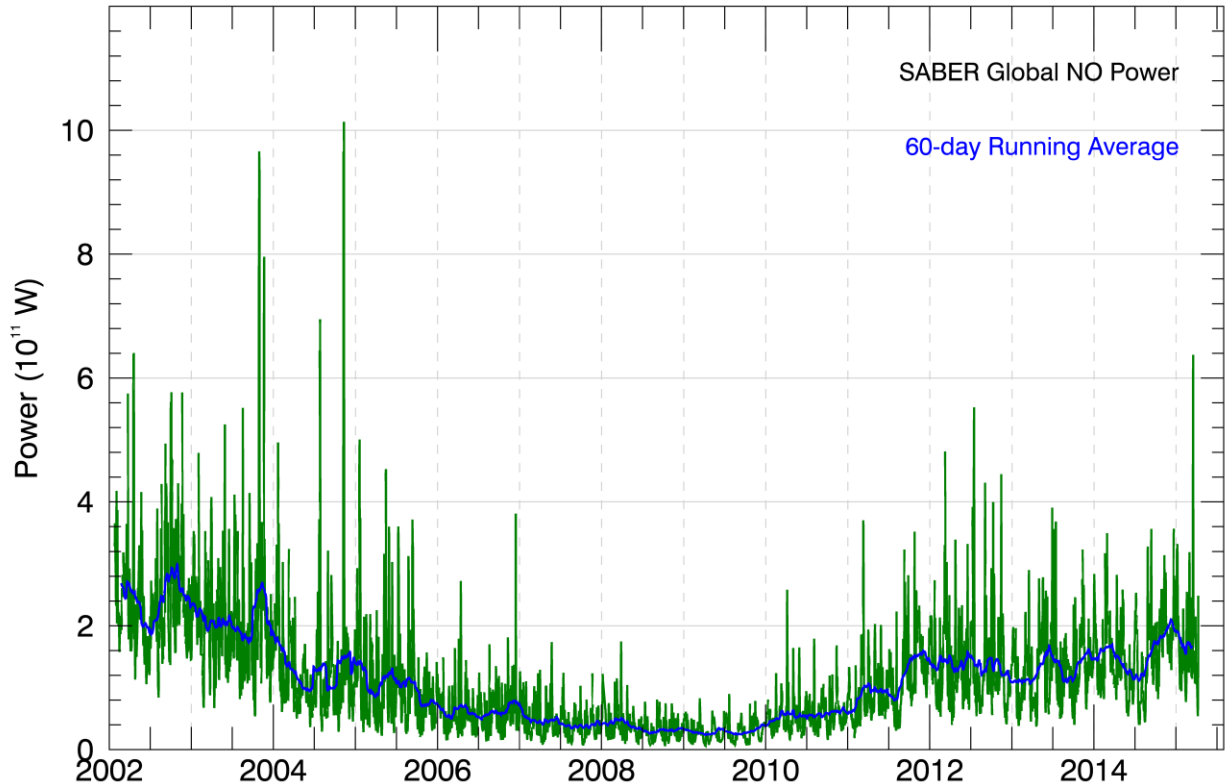


St. Patrick's Day Storm

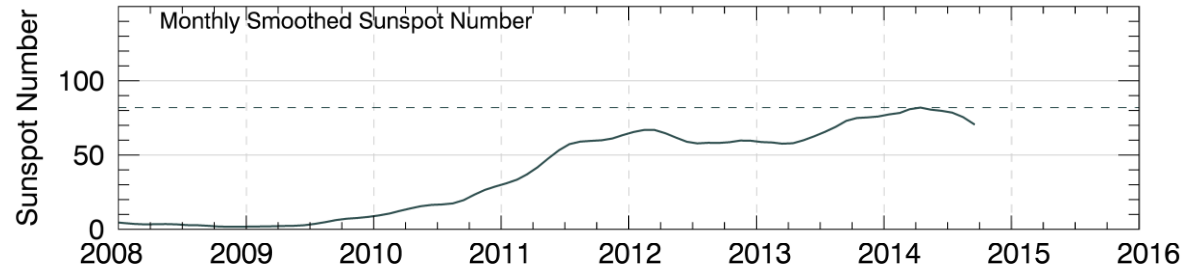


St. Patrick's Day Storm

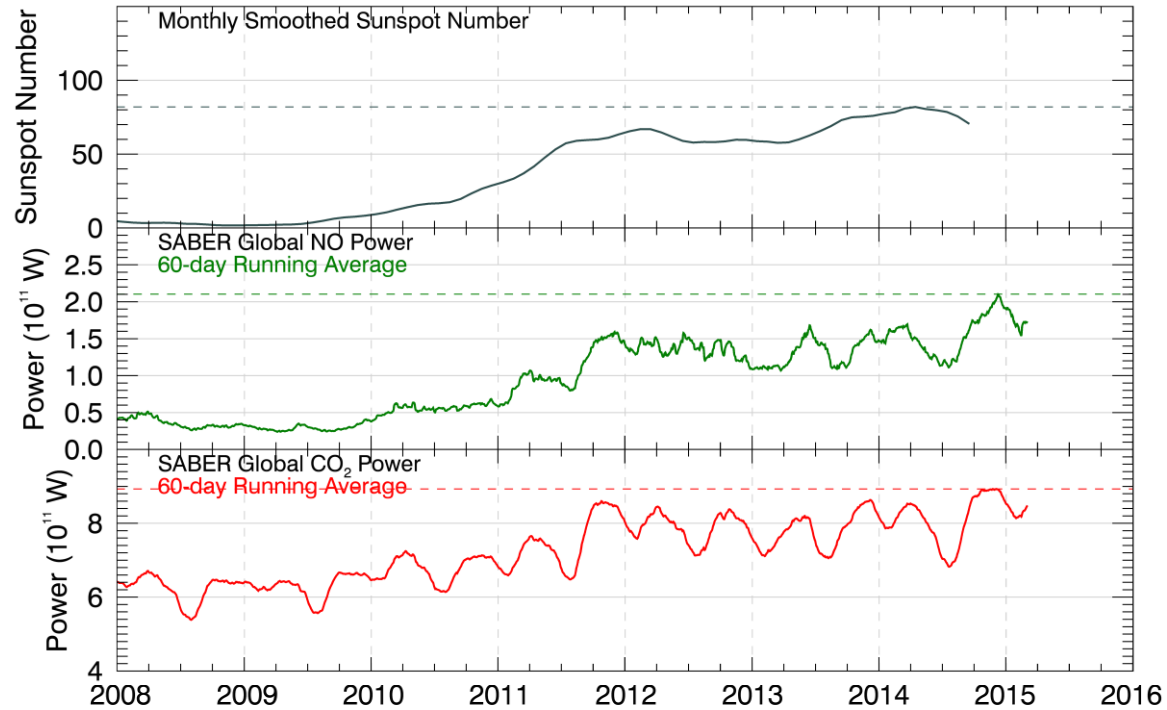
- Total power radiated
1.735 TeraWatts
NO : 1.072×10^{12} W
CO₂ : 6.631×10^{11} W
- Total energy
1.5 e+17 Joules, or
41.67 billion kW hours
- Fifth strongest storm in terms of peak power
- Strongest storm since November 2004
- But only half as strong in total energy as the Halloween 2003 storms, which totaled 79.7 billion kWh



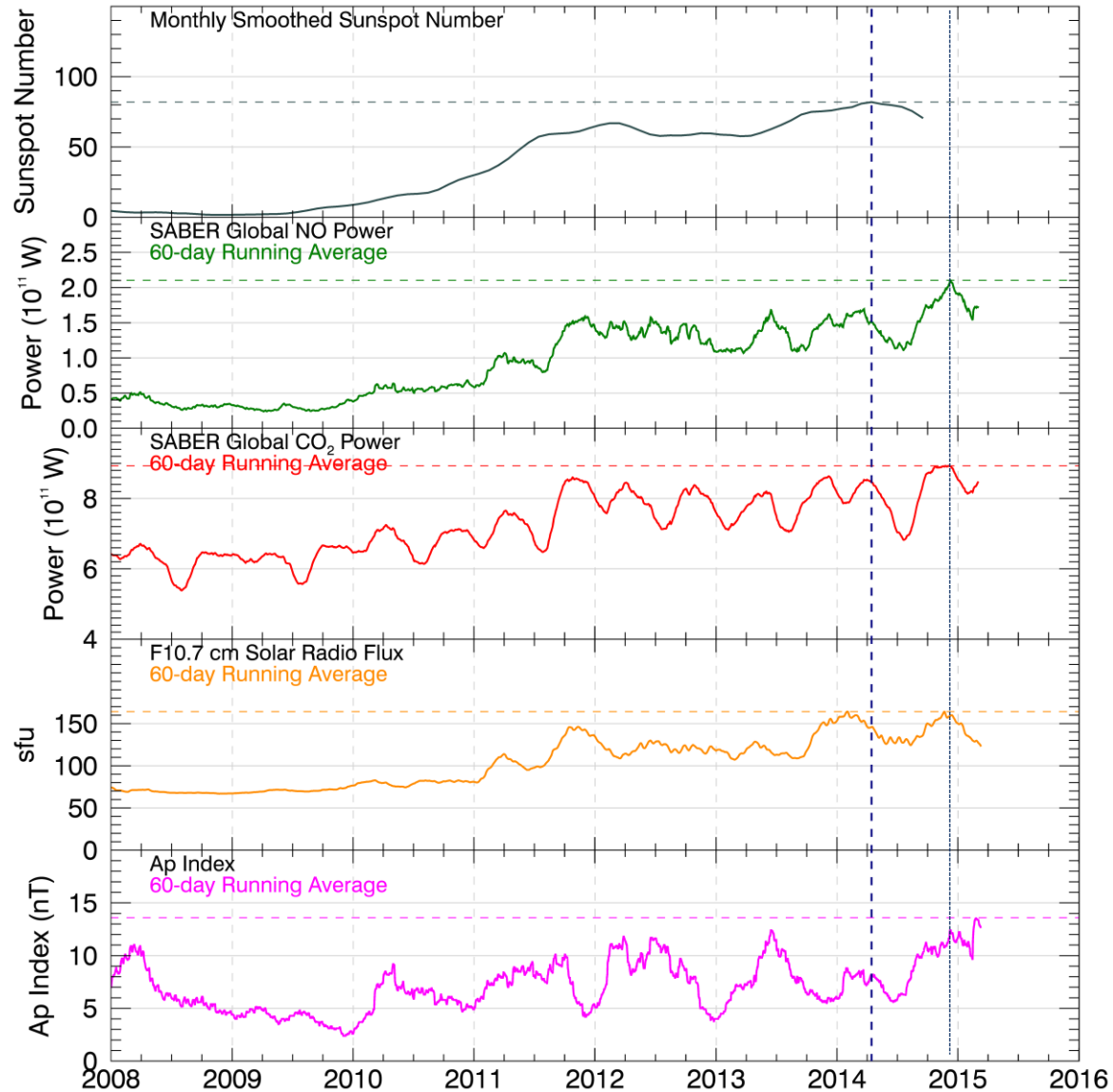
Solar Cycle 24 Max



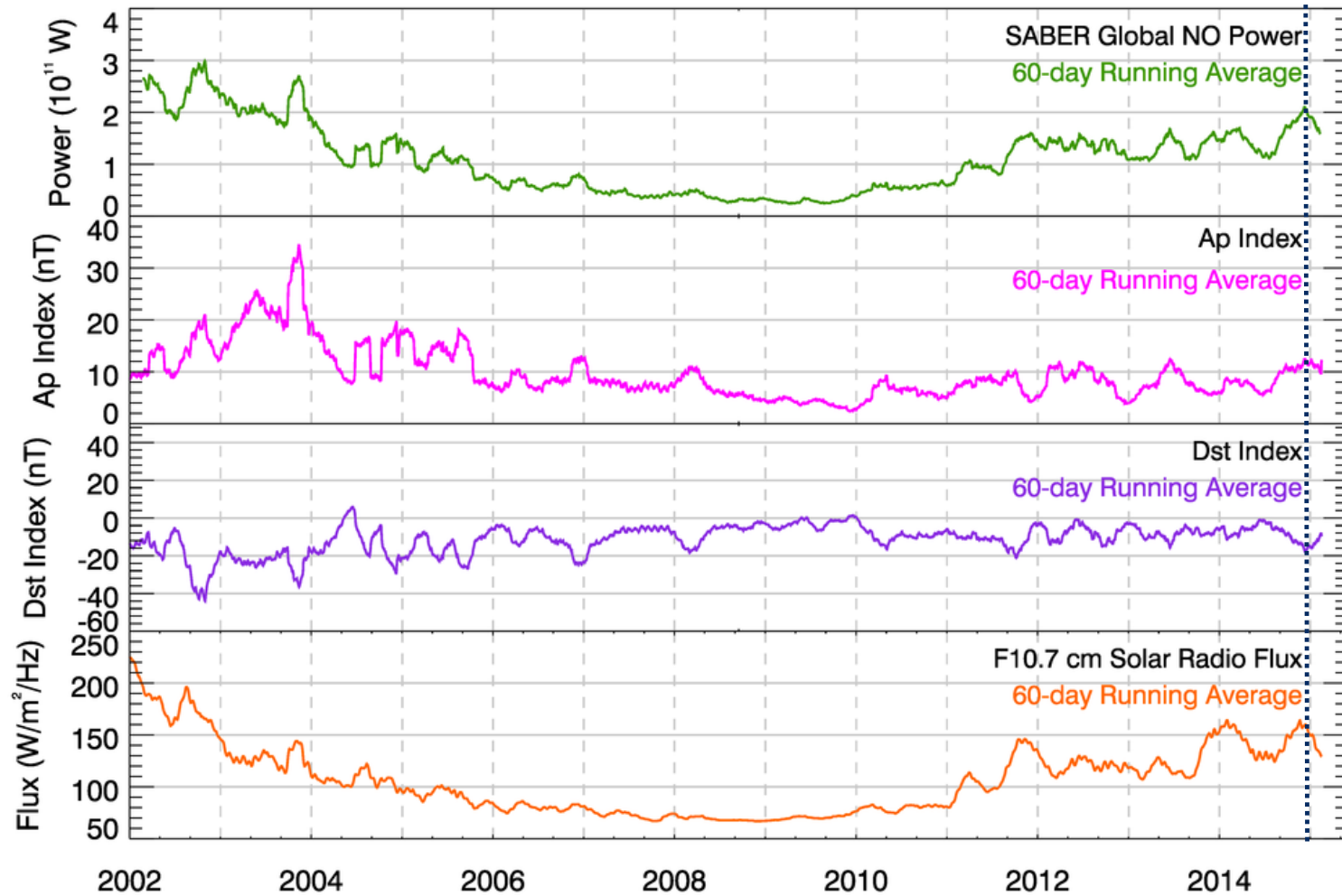
Solar Cycle 24 Max



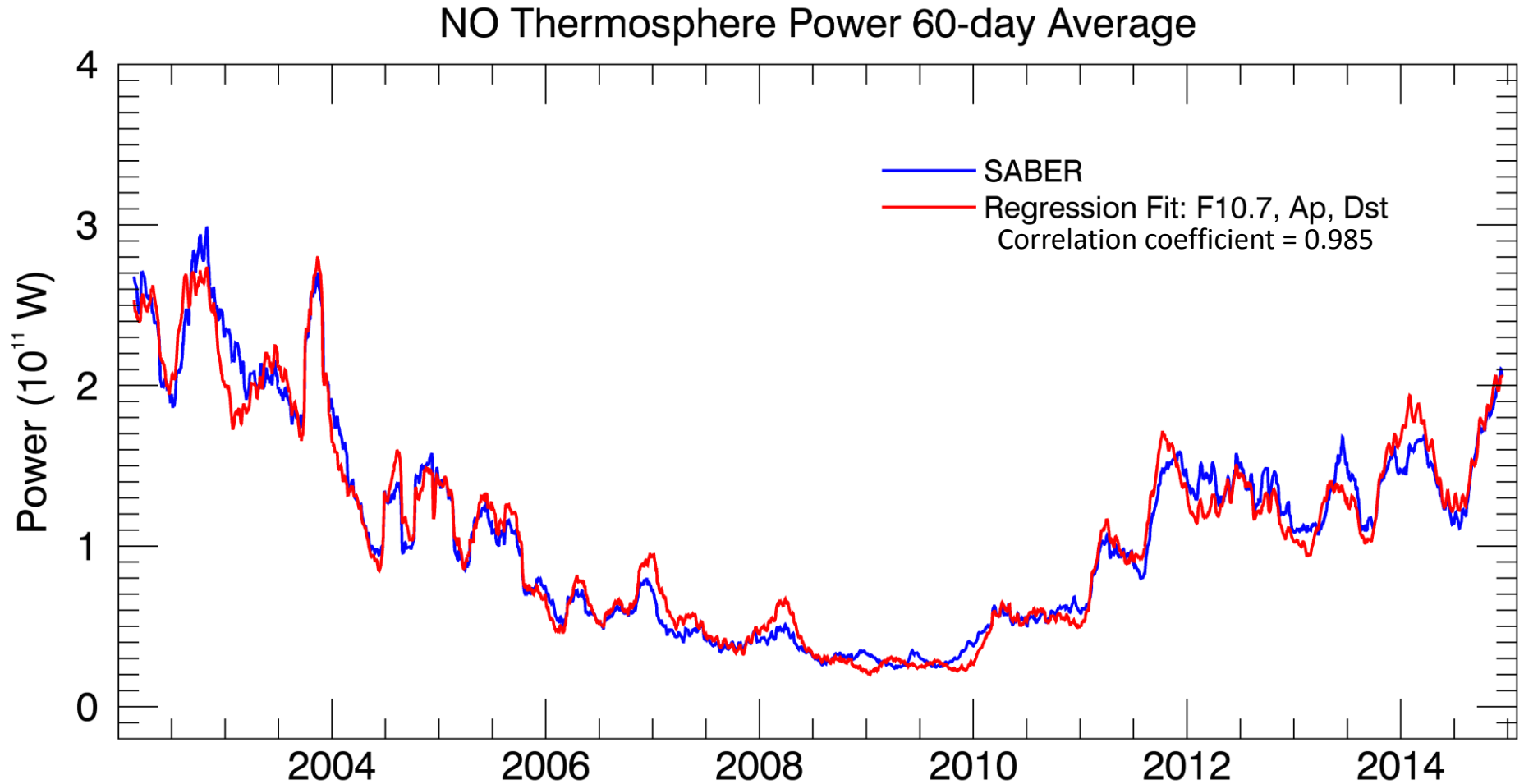
Solar Cycle 24 Max



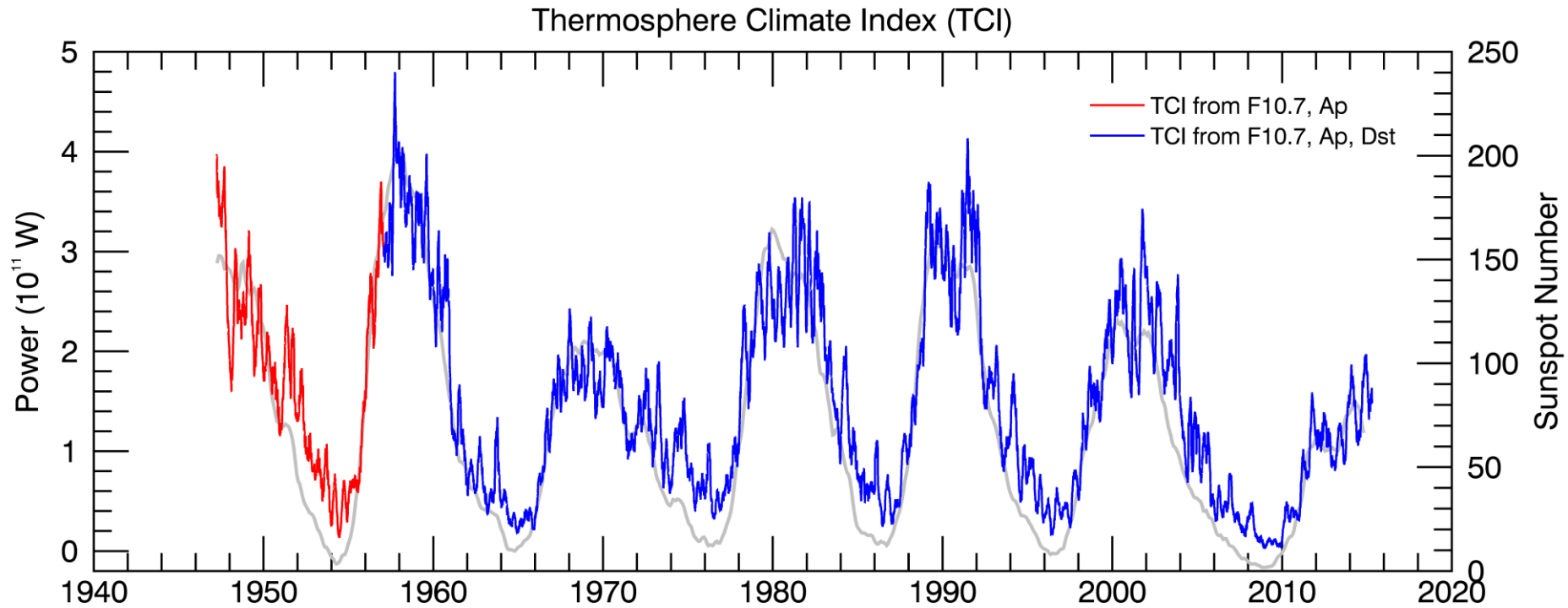
Solar Cycle 24 Max



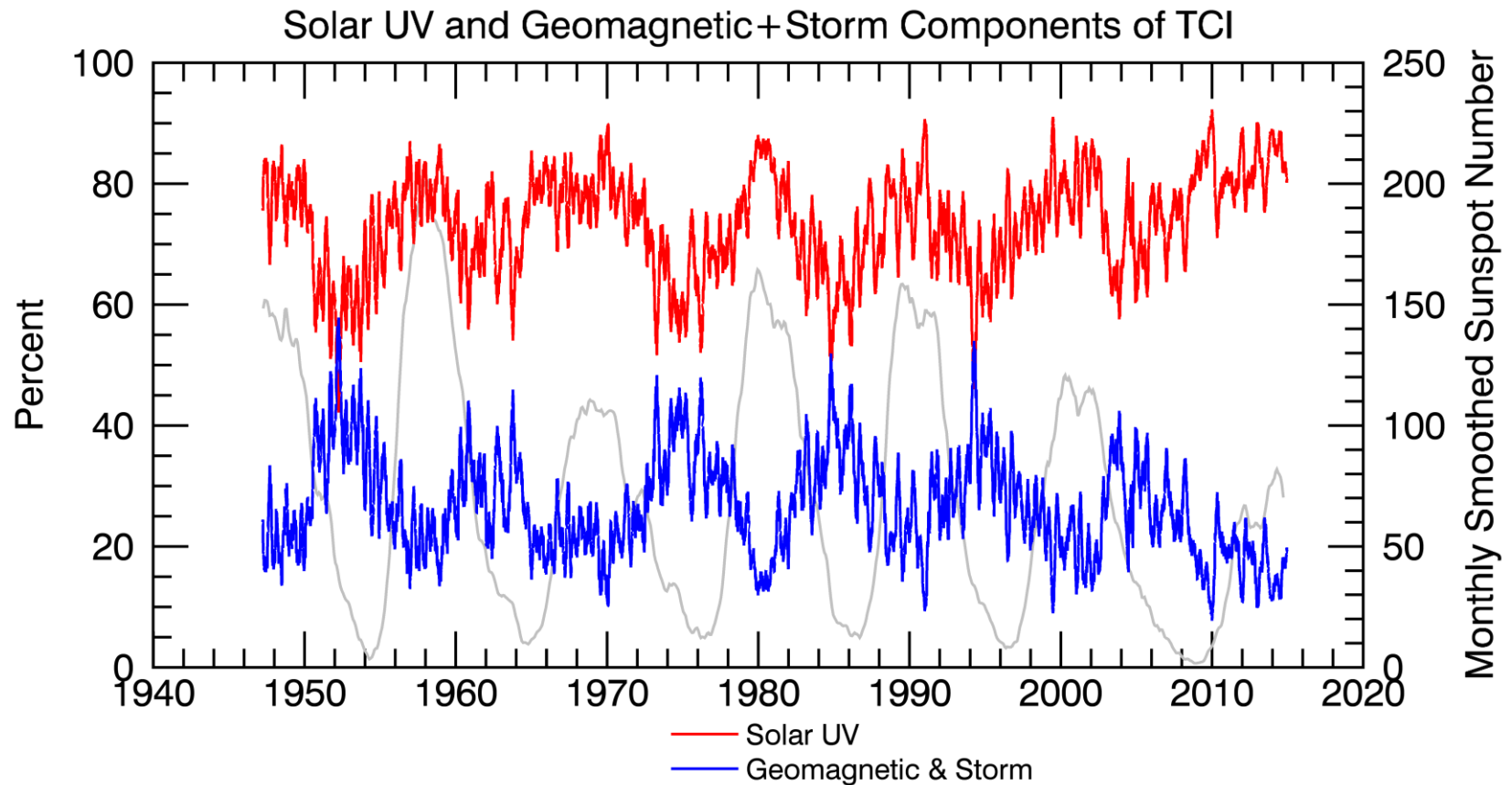
Regression Fit of SABER NO Power



Reconstructed NO Time Series



Relative Contribution of TCI Components



Summary

- Global NO and CO₂ radiated thermosphere power are highest in SC 24 in late 2014.
 - Maximum occurs with a joint maximum in Ap and F10.7, a local geomagnetic and irradiance maximum
 - Occurs 9 months after sunspot maximum
- The time series of NO global infrared radiated power can be fitted quite accurately with three solar and geomagnetic indices: F10.7 solar radio flux, the Ap index, and Dst.
- The NO power time series can then be reconstructed back to 1947
 - Enables tests of upper atmosphere models over six solar cycles
 - Illustrates relative roles of solar and geomagnetic processes in radiative cooling

Two articles on these topics
have been submitted to GRL

Backup Slides

